The Need for Conceptual Integration with Fragmented Knowledge

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The human species is currently positioned somewhere on an upwardly sloping curve in a revolution of scientific learning. However, our knowledge is fragmented, and large gaps remain in all disciplines. This deficiency challenges our abilities to integrate factual information correctly into a conceptual framework that could allow us to act for the good of humanity. In this editorial we discuss the extent of our knowledge and the many important knowledge gaps that could have profound effects on us and our common shared biosphere. We will try to illustrate these views with global planetary examples while integrating our understanding of Nature to make sound recommendations.

Our biosphere is presently under assault by 6.6 billion humans who generate more waste than has ever been produced for an equivalent period of time in the past. What's worse, our human population continues to increase at a rate of about 75 million people per year. We do know of the probable consequences of this ever

increasing number of humans on global climate change since modeling predictions have been remarkably accurate over recent years, based on the assumptions that the human population will continue to grow exponentially, and that some world citizens and our politicians would do nothing to amend our deleterious activities. But climate change is only one of the many negative consequences that ensue from the activities of people, and many of these are likely to prove extremely difficult to predict. While we know much about the general outcomes, the specifics will only be revealed as each disaster unfolds.

Some obvious consequences of overpopulation include: depletion of renewable resources, loss of ecosystems and biodiversity, devastation through the emergence of new and increasingly virulent diseases, and an insufficiency of public infrastructure to deal with the immensely complex problems we face. Rising sea levels, flooding, wild fires, droughts, and human suffering and death of a magnitude never experienced before on Earth are all to be anticipated, but we lack definitive knowledge about the quantification of any of these potential disasters. Worse, the actual list, although immense, is incomplete. Hence, knowledge fragmentation and information gaps prevent us from protecting ourselves against pending environmental disasters.

There will always be a paucity of knowledge, and this deficiency will prevent a fully rational approach to the solution of our problems. The combination of

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uncontrolled human population growth, lack of pollution control and global climate change will result in an unpredictable future with complex problems and challenges that may not be solvable. They may overwhelm us. It seems that any one of these concerns will place an immense strain on local, national and global infrastructure while imposing immense economic cost.

Let's shift our thinking to the small end of the biosphere and consider simple bacteria. There are unknown zillions of them on Earth, trillions in and on each of our bodies. What do we not know about these microbes? Do we know which species are present in the human/microbial ecosystem? Can we say what features allowed them to adapt to the human host and which cause them to become pathogenic? Is it known which genes are expressed in any one microbe under any one *in vivo* set of conditions? Can we predict what genes will be activated and silenced under any of the multitude of changing conditions that these microorganisms experience in our bodies? How frequently are genes transferred between these microbes under various conditions, promoting more rapid evolutionary change?

We barely have a clue as to the origins of the genetic instructions that have allowed these small organisms to adapt to a multitude of dynamic environments over the past four billion years, and we don't know how they will change in response to the altered, depleted or destroyed ecosystems on Earth that human activities are now creating. Again, we have vague estimates and hypotheses, but our knowledge is so incomplete and fragmented that even with all of science at our disposal, we can't make more than feeble attempts to extrapolate into the future. Our collective knowledge only gradually evolves as we very slowly extend the boundaries of what we know to be accurate while correcting misconceptions and battling the irrationality of non-scientifically trained minds.

There is always the question of which problems we should address first. That is, what must our priorities be if the human species is to be spared a nearly inevitable future of suffering? Can we identify a single problem that is more important than any of the other environmental problems we face? It seems that there is an answer to this all-important question. That all-important issue deals with human population growth, because our excessive human population is at the heart of all of our environmental problems. However, this is perhaps the most sensitive political

and social issue we face. Human population reduction can be achieved only if the countries of the world attain a degree of cooperation never before known. It will require recognition of the fact that we're all in this space ship called Earth together. That we will all sink or swim together. More specifically, we will only be able to achieve the goal of population reduction through the universal provision of birth control to all countries, regardless of economic status, paid for by the wealthier countries. Is this an achievable goal? Happily, from both practical and theoretical standpoints, it is. Estimates suggest that a mere 30 billion dollars per year would allow us to provide this service worldwide. And this is only a tiny fraction of what the richest country on Earth, the United States, now spends on war and destruction.

How do we address the problem of irrational thought promoted by mysticism and entrenched social traditions? It seems that we must invest first, in national and international education, second, in collaborative, trans-border research, and third, in broad-based economic development with the good of humanity, rather than personal gain, in mind. We must share our technologies, funds and knowledge with countries that will never be able to develop without assistance. And our efforts must insure that peace, rather than war will break out throughout the world. Wars have outlived their usefulness and their practicality. They destroy humans and our biosphere. Humans who promote wars, conflicts and destruction are exhibiting primitive, non-rational behavior that humans must evolve beyond. The intellectual deficiency they exhibit must be overcome by superior ideas and rationale intellect. They live in a world they do not understand; nor do they care to understand it. Selfish nationalistic motives must be abandoned, or at least counteracted. They are obsolete. We're all in this spaceship together. The world is shrinking, and we can no longer afford the devastation that wars cause. The entire globe is at risk as never before. We simply don't have the time to be frivolous.

Perhaps of greatest importance, educational programs must focus on practical solutions to the problems we face. Our students and future world leaders must learn to identify crucial problems before they become insurmountable and work towards implementing their solutions. The focus of education needs to evolve from memorization and short-term learning, to the development of problem identification and solu-

tions. Education must promote the realization of long-term societal benefits. The purpose of education cannot merely be to provide a means of livelihood; it must also provide encouragement and incentive for students to contribute to humanity in a responsible, meaningful

way. The continuance of humanity depends of such presuppositions. Students must know how to best use our fragmented, gap-filled knowledge to solve the problems of our planet's fragile biosphere. We must succeed and the sooner the better.